



UNION CARBIDE CORPORATION  
A Subsidiary of The Dow Chemical Company  
**MATERIAL SAFETY DATA SHEET**



Product Name: CYCLOALIPHATIC EPOXIDE RESIN ERL-4221 Effective Date: 06/29/2000

MSDS#: 3317

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Union Carbide urges each customer or recipient of this MSDS to study it carefully to become aware of and understand the hazards associated with the product. The reader should consider consulting reference works or individuals who are experts in ventilation, toxicology, and fire prevention, as necessary or appropriate to use and understand the data contained in this MSDS.

To promote safe handling, each customer or recipient should: 1) Notify its employees, agents, contractors and others whom it knows or believes will use this material of the information in this MSDS and any other information regarding hazards or safety; 2) Furnish this same information to each of its customers for the product; and 3) Request its customers to notify their employees, customers, and other users of the product of this information.

## 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

### 1.1 IDENTIFICATION

Product Name	CYCLOALIPHATIC EPOXIDE RESIN ERL-4221
Chemical Name	3,4-Epoxy Cyclohexyl Methyl-3,4-Epoxy Cyclohexyl Carboxylate
Chemical Family	Epoxides
Formula	C <sub>14</sub> H <sub>20</sub> O <sub>4</sub>
Synonym	None

### 1.2 COMPANY IDENTIFICATION

Union Carbide Corporation  
A Subsidiary of The Dow Chemical Company  
39 Old Ridgebury Road  
Danbury, CT 06817-0001

### 1.3 EMERGENCY TELEPHONE NUMBER

**24 hours a day: CHEMTREC 1-800-424-9300.**

Number for non-emergency questions concerning MSDS (732) 563-5522  
Additional information on this product may be obtained by calling the Union Carbide Corporation Customer Service Center at 1-800-568-4000.



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**Inhalation** Short-term harmful health effects are not expected from vapor generated at ambient temperature. See "Effects of Repeated Overexposure."

**Eye Contact** Excess redness and swelling of the conjunctiva may occur. Causes irritation, experienced as stinging and discomfort or pain.

**Skin Contact** Brief contact may cause slight irritation with itching and local redness.

**Skin Absorption** No evidence of harmful effects from available information.

**Swallowing** Moderately toxic. May cause abdominal discomfort, nausea, vomiting, and diarrhea.

### Chronic, Prolonged or Repeated Overexposure

**Effects of Repeated Overexposure** Prolonged or repeated overexposure to mist or vapor generated at high temperatures may result in the inhalation of harmful amounts of material.

**Other Effects of Overexposure** Skin contact may cause sensitization and an allergic skin reaction in a small proportion of individuals.

### Medical Conditions Aggravated by Exposure

A knowledge of the available toxicology information and of the physical and chemical properties of the material suggests that overexposure is unlikely to aggravate existing medical conditions.

### **3.3 POTENTIAL ENVIRONMENTAL EFFECTS**

See Section 12 for Ecological Information.

## **4. FIRST AID PROCEDURES**

### **4.1 INHALATION**

Remove to fresh air.

### **4.2 EYE CONTACT**

Immediately flush eyes with water and continue washing for several minutes. Remove contact lenses, if worn. Obtain medical attention if discomfort persists.

### **4.3 SKIN CONTACT**

Wash skin with soap and water.

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### 4.4 SWALLOWING

If patient is fully conscious, give two glasses of water. Induce vomiting. This should be done only by medical or experienced first-aid personnel. Obtain medical attention.

### 4.5 NOTES TO PHYSICIAN

There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient.

## 5. FIRE FIGHTING MEASURES

### 5.1 FLAMMABLE PROPERTIES

**Flash Point - Closed Cup:** *Pensky-Martens Closed Cup ASTM D 93* 118 °C 245 °F

**Flash Point - Open Cup:** *Cleveland Open Cup ASTM D 92* 204 °C 400 °F

**Autoignition Temperature:** *Not currently available.*

#### Flammable Limits In Air:

Lower	<i>Not determined.</i>
Upper	<i>Not determined.</i>

### 5.2 EXTINGUISHING MEDIA

Extinguish fires with water spray or apply alcohol-type or all-purpose-type foam by manufacturer's recommended techniques for large fires. Use carbon dioxide or dry chemical media for small fires.

### 5.3 EXTINGUISHING MEDIA TO AVOID

No information available.

### 5.4 SPECIAL FIRE FIGHTING PROCEDURES

Do not direct a solid stream of water or foam into hot, burning pools; this may cause frothing and increase fire intensity.

### 5.5 SPECIAL PROTECTIVE EQUIPMENT FOR FIREFIGHTERS

Use self-contained breathing apparatus and protective clothing.

### 5.6 UNUSUAL FIRE AND EXPLOSION HAZARDS

When this material is exposed to extreme heat, as in a fire, it may polymerize and rupture a closed container.

See Section 8.3 - Engineering Controls

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### **5.7 HAZARDOUS COMBUSTION PRODUCTS**

Combustion may produce the following products: Carbon monoxide and/or carbon dioxide. Carbon monoxide is highly toxic if inhaled. Carbon dioxide in sufficient concentrations can act as an asphyxiant.

## **6. ACCIDENTAL RELEASE MEASURES**

### **Steps to be Taken if Material is Released or Spilled:**

Collect for disposal. Avoid runoff to waterways and sewers. Observe government regulations.

**Personal Precautions:** Wear suitable protective equipment. See Section 8.2 - Personal Protection.

**Environmental Precautions:** This product is essentially insoluble in water. It is resistant to rapid biodegradation and may be toxic to aquatic life. Avoid discharge to sewers or to natural waters.

## **7. HANDLING AND STORAGE**

### **7.1 HANDLING**

#### **General Handling**

Avoid contact with eyes, skin, and clothing.  
Do not handle or empty in presence of flammable vapor.  
Keep container closed.  
Use with adequate ventilation.  
Wash thoroughly after handling.

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#### **Ventilation**

General (mechanical) room ventilation is expected to be satisfactory for use at room temperature. Special, local ventilation is recommended at points where vapors generated at high temperatures may be vented to the workplace air.

### **7.2 STORAGE**

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Store in accordance with good industrial practices. Storage information may be obtained from product-specific Union Carbide Storage and Handling Guides, or by calling a Union Carbide Customer Service Representative.

### **8. EXPOSURE CONTROLS AND PERSONAL PROTECTION**

#### **8.1 EXPOSURE LIMITS**

None established by OSHA, ACGIH or UCC.

#### **8.2 PERSONAL PROTECTION**

**Respiratory Protection:** Self-contained breathing apparatus may be needed if product is heated in a confined or poorly ventilated area.

**Ventilation:** General (mechanical) room ventilation is expected to be satisfactory for use at room temperature. Special, local ventilation is recommended at points where vapors generated at high temperatures may be vented to the workplace air.

**Eye Protection:** Safety glasses or monogoggles.

**Protective Gloves:** Polyvinyl chloride coated

**Other Protective Equipment:** Eye Bath, Safety Shower

#### **8.3 ENGINEERING CONTROLS**

**PROCESS HAZARD:** Sudden release of hot organic chemical vapor or mists from process equipment operating at elevated temperature and pressure, or sudden ingress of air into hot equipment under a vacuum, may result in ignitions without the presence of obvious ignition sources. Published "autoignition" or "ignition" temperature values cannot be treated as safe operating temperatures in chemical processes without analysis of the actual process conditions. Any use of this product in elevated-temperature processes should be thoroughly evaluated to establish and maintain safe operating conditions. Further information is available in a technical bulletin entitled "Ignition Hazards of Organic Chemical Vapor."

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### 9. PHYSICAL AND CHEMICAL PROPERTIES

**Physical State:** Slightly viscous liquid

**Appearance:** Almost transparent colorless

**pH:** *Not currently available.*

**Solubility in Water (by weight):** 20 °C < 0.06 %

**Odor:** No detectable odor.

**Flash Point - Closed Cup:** *Pensky-Martens Closed Cup ASTM D 93* 118 °C 245 °F

**Flash Point - Open Cup:** *Cleveland Open Cup ASTM D 92* 204 °C 400 °F

**Molecular Weight:** 252.30 g/mol

**Boiling Point (760 mmHg):** > 250 °C > 482 °F Decomposes; Boiling point = 170°C (338°F) at 1 mmHg

**Freezing Point:** *Sets to glass* -37 °C -35 °F

**Specific Gravity (H<sub>2</sub>O = 1):** 1.173 20 °C / 20 °C

**Vapor Pressure at 20°C:** ~ 0.000 kPa ~ 0.000 mmHg

**Vapor Density (air = 1):** 8.7

**Melting Point:** *Not applicable.*

### 10. STABILITY AND REACTIVITY

**10.1 STABILITY/INSTABILITY** Stable

**Incompatible Materials:** Amines. Acids. Strong bases.

**Hazardous Decomposition Products:** Combustion may produce the following products: Carbon monoxide and/or carbon dioxide. Carbon monoxide is highly toxic if inhaled; carbon dioxide in sufficient concentrations can act as an asphyxiant.

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**10.2 HAZARDOUS POLYMERIZATION** May occur.

**Conditions to Avoid :** Amines. Acids. Strong bases.

**10.3 INHIBITORS/STABILIZERS** Not applicable.

### **11. TOXICOLOGICAL INFORMATION**

#### **ACUTE TOXICITY**

##### **Peroral**

Rat; LD50 = 4.49 (1.81 - 11.2) ml/kg

**Major Signs:** None.

**Gross Pathology:** discolored lungs and abdominal viscera; liver burned where in contact with stomach.

##### **Percutaneous**

Rabbit = 20 ml/kg; 24 h occluded.

**Mortality:** 1/4

**Major Signs:** None.

**Gross Pathology:** None.

##### **Inhalation**

dynamic generation of vapor Rat; 8 hour; 21 °C.

**Mortality:** 0/6

**Major Signs:** None.



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**Gross Pathology:** None.

### **IRRITATION**

**Skin:** Rabbit; 24 h uncovered

**Results:** minimal erythema in 1/5, no irritation in 4/5

**Eye:** Rabbit; 0.5 ml

**Results:** minor conjunctival irritation with discharge, no corneal injury

### **SENSITIZATION (ANIMAL AND HUMAN STUDIES)**

Maximization Test, intradermal injection of a 5% dilution in propylene glycol followed by topical application of undiluted material: Guinea pig; moderate erythema in 12/19 upon challenge

### **CHRONIC TOXICITY AND CARCINOGENICITY**

This material has exhibited evidence of mutagenic activity in several in vitro test systems. The material did not exhibit carcinogenic potential in lifetime mouse skin-painting studies. The relevance of these findings to humans is unknown.

### **SIGNIFICANT DATA WITH POSSIBLE RELEVANCE TO HUMANS**

In reporting a recent basic research study, Bentley, et al. (CARCINOGENESIS 10:321, 1989) suggested that mixtures of the diglycidyl ether of bisphenol A (DGEBA) and cycloaliphatic epoxides might have the potential to produce skin cancer under conditions of long-term skin contact. This speculation arose in attempting to explain the previously reported potentiation of dermal carcinogenicity of a mixture of DGEBA and one particular epoxide, bis epoxy cyclopentyl ether (Holland, et al. CANCER RESEARCH 39:1718, 1979) via the inhibition of the detoxifying enzyme, epoxide hydrolase. Subsequently, similar in vitro studies have shown that ERL-4221 does not alkylate a DNA surrogate to any significant extent, is relatively rapidly hydrolyzed, and weakly inhibits epoxide hydrolase. The authors of this in vitro study concluded that ERL-4221 in combination with bisphenol epoxides is "unlikely to increase a putative genotoxicity of the co-administered epoxide". Union Carbide believes that, based on the available evidence, ERL-4221 is unlikely to elicit a carcinogenic effect either alone or admixed with DGEBA. No significant hazard is perceived as long as normal practices of avoiding skin contact are followed. This material has exhibited evidence of mutagenic activity in several in vitro test systems. The material did not exhibit carcinogenic potential in lifetime mouse skin-painting studies. The relevance of these findings to humans is unknown.

## **12. ECOLOGICAL INFORMATION**

### **12.1 ENVIRONMENTAL FATE**

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Information may be available, call Union Carbide.

### **12.2 ECOTOXICITY**

Information may be available, call Union Carbide.

### **12.3 FURTHER INFORMATION**

None.

## **13. DISPOSAL CONSIDERATIONS**

### **13.1 WASTE DISPOSAL METHOD**

Dilute with an inert solvent and incinerate in a furnace where permitted under appropriate Federal, State, and local regulations. Dispose in accordance with all applicable Federal, State, and local environmental regulations. Empty containers should be recycled or disposed of through an approved waste management facility.

### **13.2 DISPOSAL CONSIDERATIONS**

See Section 13.1

*Disposal methods identified are for the product as sold. For proper disposal of used material, an assessment must be completed to determine the proper and permissible waste management options permissible under applicable rules, regulations and/or laws governing your location.*

## **14. TRANSPORT INFORMATION**

### **14.1 U.S. D.O.T.**

#### **NON-BULK**

**Proper Shipping Name :** NOT REGULATED

#### **BULK**

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**Proper Shipping Name :** NOT REGULATED

*This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.*

### **15. REGULATORY INFORMATION**

#### **15.1 FEDERAL/NATIONAL**

##### **COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 SECTION 103 (CERCLA)**

The following components of this product are specifically listed as hazardous substances in 40 CFR 302.4 (unlisted hazardous substances are not identified) and are present at levels which could require reporting:

None.

##### **SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 TITLE III (EPCRA) SECTIONS 302 AND 304**

The following components of this product are listed as extremely hazardous substances in 40 CFR Part 355 and are present at levels which could require reporting and emergency planning:

None.

##### **SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 TITLE III (EPCRA) SECTION 313**

The following components of this product are listed as toxic chemicals in 40 CFR 372.65 and are present at levels which could require reporting and customer notification under Section 313 and 40 CFR Part 372:

This product does not contain toxic chemicals at levels which require reporting under the statute.

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### SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 TITLE III (EPCRA) SECTIONS 311 AND 312

Delayed Hazard : Yes

Fire Hazard : No

Immediate Health Hazard : Yes

Reactive Hazard : Yes

Sudden Release of Pressure Hazard : No

### TOXIC SUBSTANCES CONTROL ACT (TSCA)

All components of this product are on the TSCA Inventory or are exempt from TSCA Inventory requirements.

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### EUROPEAN INVENTORY OF EXISTING COMMERCIAL CHEMICAL SUBSTANCES (EINECS)

The components of this product are on the EINECS inventory.

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### CEPA - DOMESTIC SUBSTANCES LIST (DSL)

The components of this product are on the DSL or are exempt from reporting under the New Substances Notification Regulations.

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## 15.2 STATE/LOCAL

### PENNSYLVANIA (WORKER AND COMMUNITY RIGHT-TO-KNOW ACT)

This product is subject to the Worker and Community Right-to-Know Act. The following components of this product are at levels which could require identification in the MSDS:  
None.

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### MASSACHUSETTS (HAZARDOUS SUBSTANCES DISCLOSURE BY EMPLOYERS)

The following components of this product appear on the Massachusetts Substance List and are present at levels which could require identification in the MSDS:  
None.

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### CALIFORNIA PROPOSITION 65 (SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986)

This product contains no listed substances known to the State of California to cause cancer, birth defects or other reproductive harm, at levels which would require a warning under the statute.

### CALIFORNIA SCAQMD RULE 443.1 (SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT RULE 443.1, LABELING OF MATERIALS CONTAINING ORGANIC SOLVENTS)

VOC: Vapor pressure <0.01 mmHg at 20°C  
0.00 g/l VOC

*This section provides selected regulatory information on this product including its components. This is not intended to include all regulations. It is the responsibility of the user to know and comply with all applicable rules, regulations and laws relating to the product being used.*

## **16. OTHER INFORMATION**

### **16.1 AVAILABLE LITERATURE AND BROCHURES**

Additional information on this product may be obtained by calling the Union Carbide Corporation Customer Service Center at 1-800-568-4000.

### **16.2 SPECIFIC HAZARD RATING SYSTEM**

**||HMIS ratings for this product are: H - 2      F - 1      R - 1**

**||NFPA ratings for this product are: H - 2      F - 1      R - 1**

*These ratings are part of specific hazard communications program(s) and should be disregarded where individuals are not trained in the use of these hazard rating systems. You should be familiar with the hazard communication applicable to your workplace.*

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### 16.3 RECOMMENDED USES AND RESTRICTIONS

FOR INDUSTRY USE ONLY

### 16.4 REVISION

Version: 3.

Revision: 06/29/2000

Most recent revision(s) are noted by the bold, double bars in left-hand margin throughout this document.

### 16.5 LEGEND

<b>A</b>	Asphyxiant
<b>Bacterial/NA</b>	Non Acclimated Bacteria
<b>F</b>	Fire
<b>H</b>	Health
<b>HMIS</b>	Hazardous Materials Information System
<b>N/A</b>	Not available
<b>NFPA</b>	National Fire Protection Association
<b>O</b>	Oxidizer
<b>P</b>	Peroxide Former
<b>R</b>	Reactivity
<b>TS</b>	Trade Secret
<b>VOL/VOL</b>	Volume/Volume
<b>W</b>	Water Reactive
<b>W/W</b>	Weight/Weight

*The opinions expressed herein are those of qualified experts within Union Carbide. We believe that the information contained herein is current as of the date of this Material Safety Data Sheet. Since the use of this information and the conditions of the use of the product are not under the control of Union Carbide, it is the user's obligation to determine conditions of safe use of the product.*